§ 216. **The excentricity of the pith in Rhus Toxicodendron.**—If we examine a cross-section of the stem of the Poison Ivy, we soon find that the excentricity of the pith is due to both the greater number of cells on the supported side and their larger size. The ducts particularly are much larger on the supported side, while there is no such marked difference in reference to the prosenchymatic wood-cells. In the sections on my slides the average diameter of the ducts on the smaller side is .04 m. m., while on the larger side it is .11 m. m. The prosenchymatic wood-cells measure on both sides from .013 to .014 m. m.

As the lateral rootlets undoubtedly play an important part in the life of our plant, I examined a considerable number of sections from such places where those roots are inserted in the body of the stem. None of them are merely superficial, but they all arise more or less deeply in the stem, at the outside of some layer of the fibro-vascular bundles, piercing, therefore, both the concentric circles of the cambium and the phloem or bast layers. Their ends within those woody tissues are conical or club-shaped, often bottle-shaped, and they are firmly wedged in between the wood-cells and ducts. Invariably one of the medullary rays terminates at the extremity of the rootlets. They are formed, as all roots, of some outer layers of wide, thin-walled, parenchymatic, and of a body of long, prosenchymatic wood-cells, with dotted ducts among them; but I could not find any pith. The outer layers of their cells are in close connection with the adjoining cells of the stem, which they meet at different angles. This connection can be noticed very plainly, especially on longitudinal sections parallel to tangents.

After this short anatomical examination we are perhaps better prepared to discuss the physiological question. What makes the woody tissues nearest the support of the plant grow so much more vigorously than those on the opposite side?

Before trying to answer this question, allow me to state briefly, what our best authorities, such as Dr. Jul. Sachs, think about the process of cell-growth in general. No cell can grow, unless it is sufficiently supplied with water. But here we have to distinguish between cells with perfectly closed, usually thin walls (such as probably all young cells have), and cells whose walls are perforated (for instance, ducts). In the first case, the water, by endosmose, enters the lumen of the cell and completely fills it. But the endosmotic force not only fills the inner space of the cell, but causes a powerful tension of its walls, the so-called turgor. This turgescence cannot take place without removing the molecules, forming the cell-walls, from one another, and it is at this stage that particles of new matter, kept in solution in the water, are deposited between the molecules, so that afterwards, even when the turgos subsides, the cell retains its greater size. In cells with perforated walls there can, of course, be no turgescence, and here it is the imbibition of water by the thick cell-walls themselves that makes them turgid, whereupon, as in other cell-walls, interposition of new material causes the growth of the cell.

If we accept this theory, and I think we must, for want of one more plausible, we have to believe, that without turgescence or im-

bibition there is no growth, and that, the more intense they are, the more rapidly the increase takes place—in other words, seemingly a very trivial result, the more water is supplied to a cell, other essential conditions of course being alike, the larger will it grow.

Now, if we agree upon this, in the case of Rhus, I think it is very natural to suppose, that the tissues on the supported side must be better supplied with water than the others. (I say with *water*, not with nourishing sap, generally.) This more abundant supply of water would explain the greater activity of the cambium-cells in forming new cells, as their turgescence would be so much more intense, than on the opposite side, and it would also account for the extraordinary growth of the ducts by the increased facility for imbibition.

But where is that increased supply of water to come from? Why, nothing prevents the lateral rootlets from acting as water-carriers; they start from and are in close connection with the prosenchymatic wood-cells and the ducts, the very tissues whose principal function it is to convey the water to such places where it is needed.

The only question is: Have those rootlets any water to carry? or, Where do they receive it from? I have examined several hundred plants of Rhus toxicodendron growing on trees. Of the first one hundred I kept accounts for the individual plants. An overwhelming majority of them grew on the east, north-east, north or north-west side of the trees. A remarkably interesting object is a long, old wall near the R. R. station, at Grinnell, on L. I., which runs from north to south. While on its east side the wall is so covered up by the most luxurious growth of Rhus, that hardly a brick can be seen; the west side can boast only of a very few stragglers. Besides, I noticed very many plants that started from the ground, on the south side of trees. After a very short trip upward on that side, the stem would turn either west or east, and finally ran all the way up on the north side.

Now it seems to be evident, that in these cases the stem wound its way to such places, where its rootlets could find most moisture in the cracks and recesses of the corky bark, and that is, of course, on the most shady side, the same that is so much preferred by cryptogamic plants, which seem to know, too, that the atmospheric moisture is retained there longer and in greater quantity.

I will just mention another observation bearing upon this point. In places where Rhus abounds, I found none growing on the smooth bark of beech-trees, while the oak, hickory and liquidambar of the same locality were well patronized.

In conclusion, therefore, I venture to say: If we adopt the present theory referring to turgor and imbibition, and if it is true that the Poison Ivy thrives best in places where its lateral rootlets will find most moisture, cæteris paribus, we must suppose, that the excess of moisture supplied to the tissues of the supported side by the rootlets is the chief, if not the only, cause of the astonishing increase of the cells in number and size, and finally of the excentricity of the pith.

I have somewhat lengthily dwelt upon this subject, because some

of the observers, whose opinions were published, seemed to be inclined to believe in the parasitic nature of the lateral roots, while others sought to maintain that they do not contribute to the plant any nourishment whatever. JOS. SCHRENK.

COLLEGE POINT, Jan., 1878.

§ 217. **Camptosorus in Eastern Massachusetts.**—The discovery of Camptosorus in Eastern Massachusetts would indeed be an event that all lovers of ferns would hail with joy, but the question that will come first to every one will be,—Is it indigenous, and to what extent?

The species is one that is considered as peculiar to limestone regions, and is usually sought for in those regions alone, although it is not always found growing on limestone rocks. It has, however, always been confined to the limits of a prescribed range, out of which it has seldom, or never been found growing naturally.

That it should have been discovered in a locality so far out of its known range, in a comparatively level country, and in a town where no lime rock occurs, with no intermediate stations between it and its western habitats, would be surprising indeed, if it could be shown that it was really indigenous there. If such were the case, we might expect, from the very proliferous nature of this species, to find it in considerable quantity, but we do not. There are only three or four of the principal plants with a few small plantlets growing in the crevices of the rock.

Having recently visited the locality in company with Mr. Storrow Higginson, who discovered it, I can verify the presence of the species there, but feel compelled to record my conviction that it is not indigenous, first, because the few plants there are of a weakly growth, and do not manifest sufficient vitality to render it probable that they are growing there naturally; second, because the locality is altogether too far out of its known range with no intermediate stations; and lastly, because the whole conformation of the surrounding country is opposed to it.

How then came the plants there? Mr. Higginson's theory is that the spores had been wafted by the wind from the mountainous regions, and regards it as an interesting incident in the migration of plants. If this is correct then we may expect to hear of other localities being discovered in the "path of the wind."

My own theory is that the plants have originated from other plants set out there at some time under favorable conditions, and have propagated either from spores blown into the crevices, or by means of the rooting apex of mature fronds.

That plants of this, and other species have been placed in out of the way places in the vicinity of Boston by different botanists I know, and have no doubt the recently discovered Camptosorus, so near to Boston, originated in this way.

Be this as it may, the plants are there growing quite naturally, and propagating themselves, as the little plantlets testify, and I sincerely trust that no one, who may chance to come upon them will ever disturb them, but regard the locality as something sacred.

BOSTON, MASS., Jan., 1878. G. E. D.